

Welcome to the

# Gilbert Water Treatment Pilot

## What are we doing?

This is a 1/6,000 scaled-down version of the planned full-sized water treatment plant. We are investigating how to optimize new and existing processes to remove specific water contaminants.

## What are the goals?



### **Reduce Disinfection Byproduct (DBP)**

Why reduce this?

It can be linked to cancer.



### **Remove Total Organic Carbon (TOC)**

Why remove this?

Contributes to DBP formation.

Learn more at:  
[gilbertaz.gov/WA1589](http://gilbertaz.gov/WA1589)



# Glossary

## Biofiltration

Microbes are encouraged to grow on the filter media. These microbes clean the water by eating carbon that has not been removed in the treatment process. The filter also traps any remaining solids.

## Disinfection Byproduct (DBP)

Formed when TOC reacts with a disinfectant. The disinfectant is needed to inactivate pathogens, but when combined with TOC, it can form DBPs, some of which can cause health issues.

## Ozone

You may have heard of the ozone layer in the atmosphere that protects us from the sun's UV radiation. A similar chemical process that protects us from UV is used in water treatment to break larger compounds into more manageable chunks.

## Total Organic Carbon (TOC)

Accounts for all the carbon in the water that isn't inorganic (ie carbon dioxide). Some examples of TOC come from plant matter like the coloration you see in coffee or tea.

## Coagulation/Flocculation

Process where smaller solids stick together to form large clumps, usually with the help of a chemical addition and gentle mixing. Larger clumps can sink to the bottom of the water better.

## Granular Activated Carbon (GAC)

This is basically a large Brita filter. Carbon is "activated" when it goes through a process to create more surface area. More surface area means more space for contaminants to stick to.

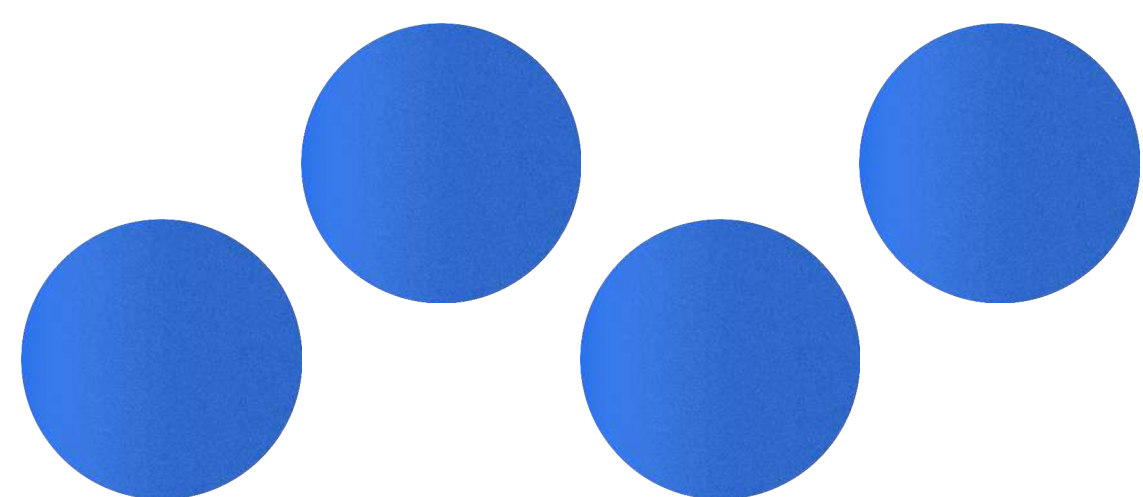
## Sedimentation

Process where solids sink to the bottom of the water due to gravity. Solids at the bottom are removed and the clean water above moves on for further treatment.



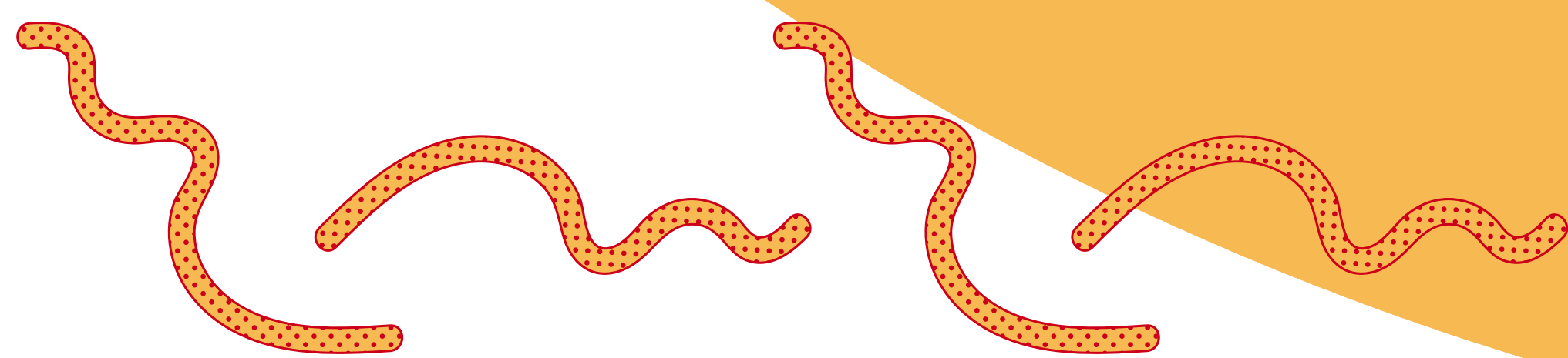


# How Are DBP & TOC Related?



**DISINFECTANT**

Added during water treatment to inactivate pathogens.



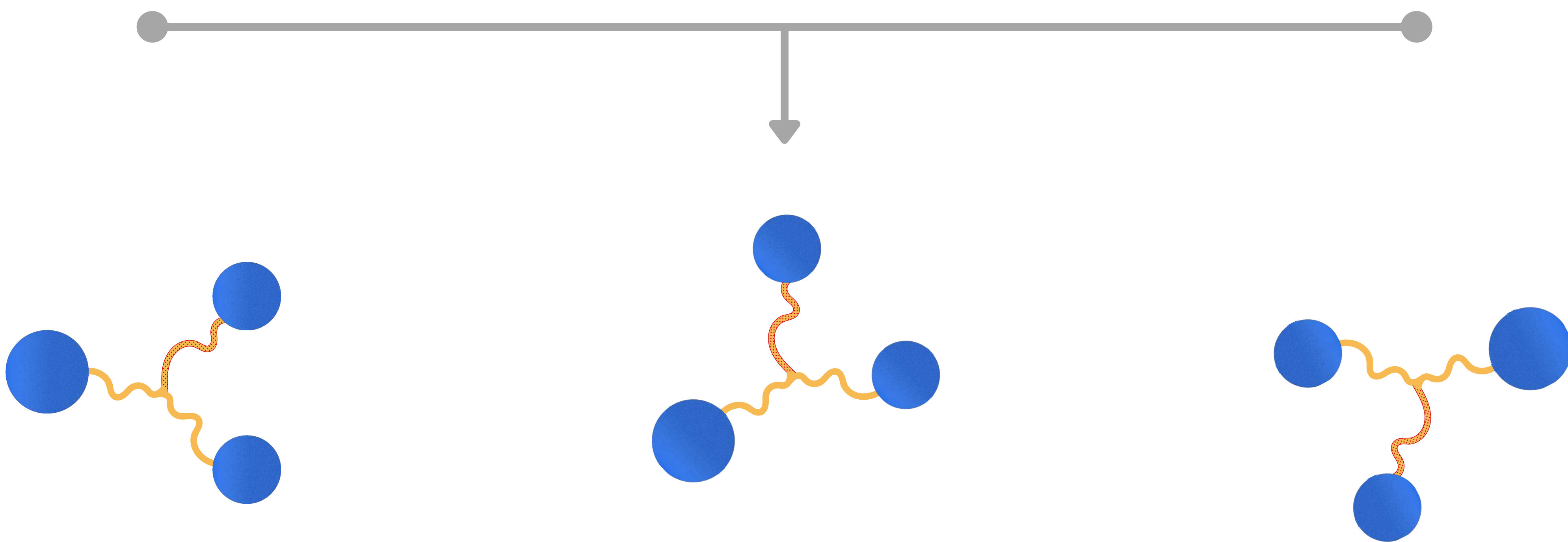
**TOC**

TOTAL ORGANIC CARBON

Gilbert's water naturally has a lot of this.



Target removal of TOC, the DBPs' "building blocks".



**DBP FORMATION**

DISINFECTION BYPRODUCT

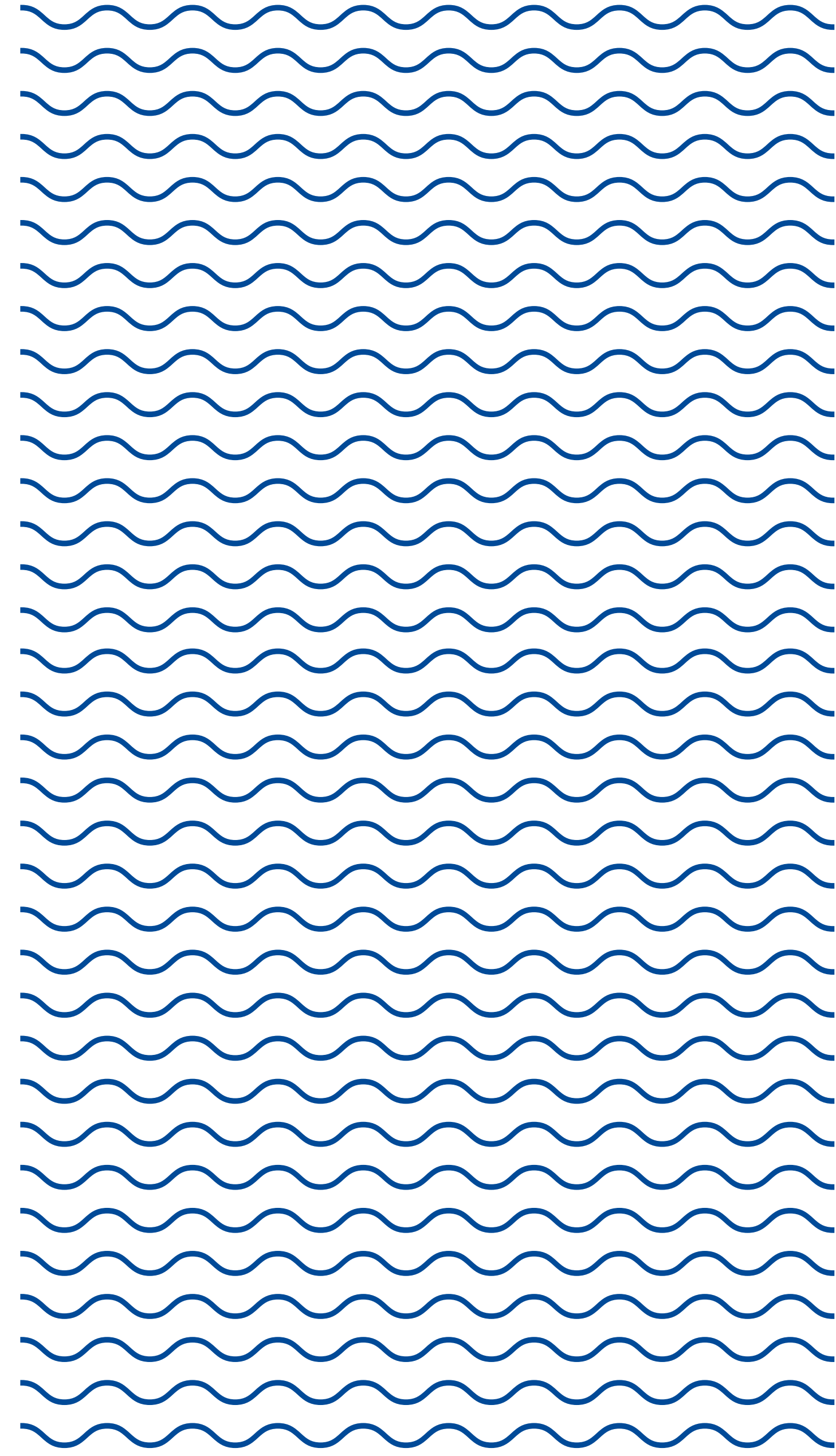
Gilbert forms a high concentration of this due to the high TOC content.



Remove the DBPs directly.

# Pilot Process Overview

We're using this pilot to determine the following about Gilbert's new water treatment plant:



**Pre-Sedimentation**

**Pre-Ozonation**

**Flocculation & Sedimentation**

**Intermediate Ozonation**

**Filtration**

**GAC**



## Sequencing

How do we optimize TOC removal based on the order of chemicals added?

## Chemical Dosing

How much of each chemical is needed?

## TOC Removal

## Evaluate Performance

How do these perform based on the media type or available TOC?

## Chlorine Impacts

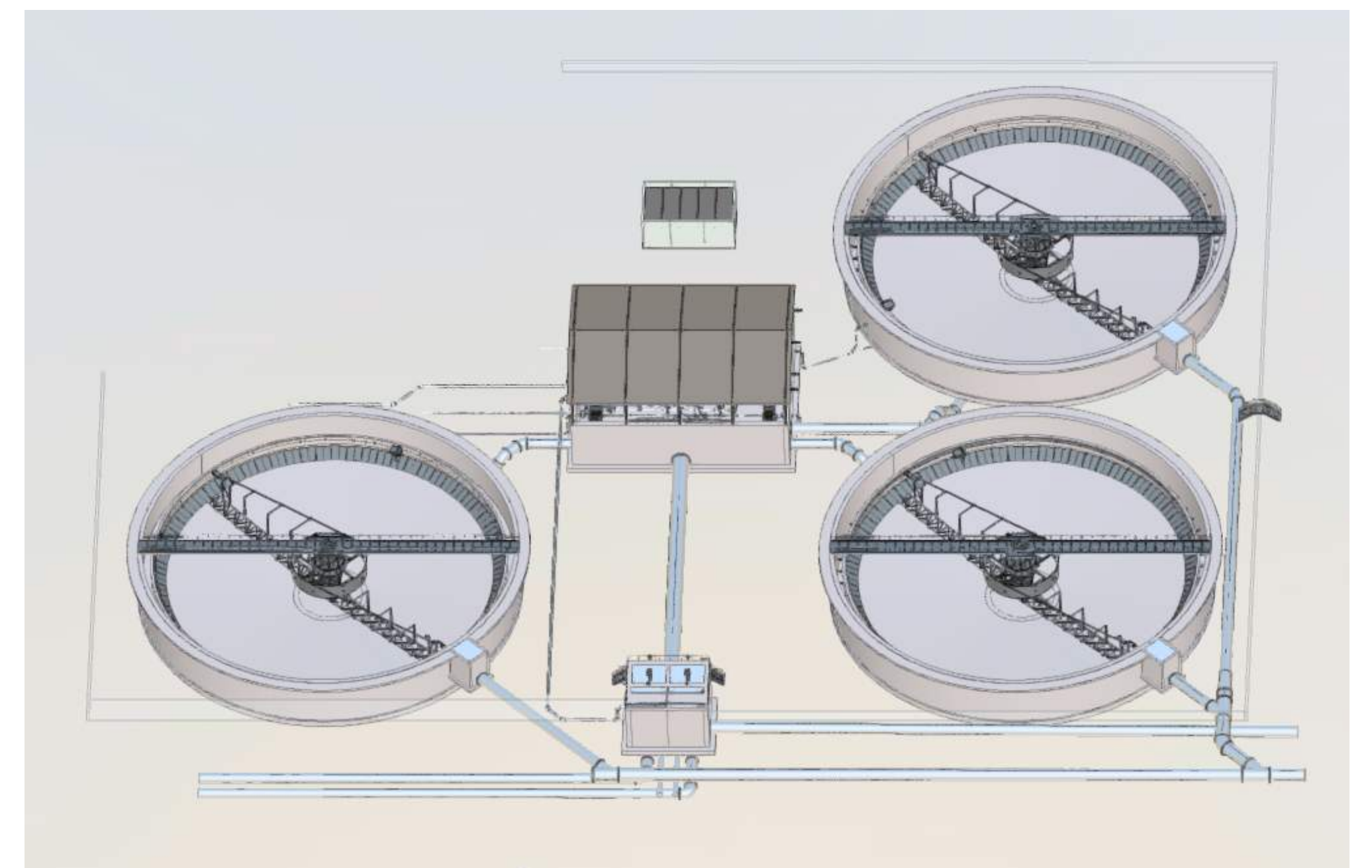
How does chlorine preserve GAC and optimize DBP reduction?



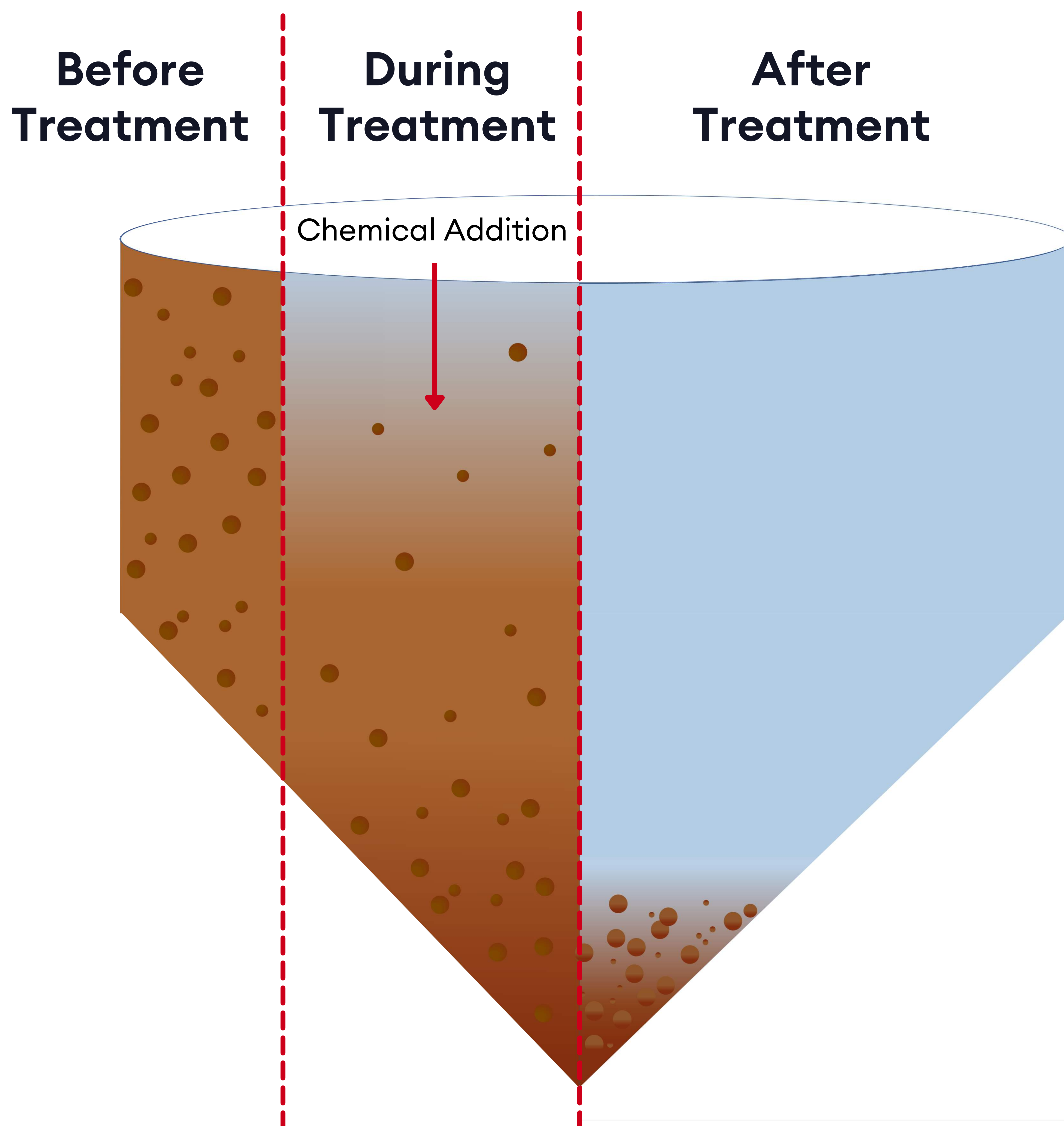
# Pre-Sedimentation

## What does pre-sedimentation do?

Remove any solids that can settle out of the water and serve as a buffer for changes in the source water.



3D model of the planned water treatment plant's pre-sedimentation basins



Pre-Sedimentation

Pre-Ozonation

Flocculation/  
Sedimentation

Intermediate  
Ozonation

Biofiltration

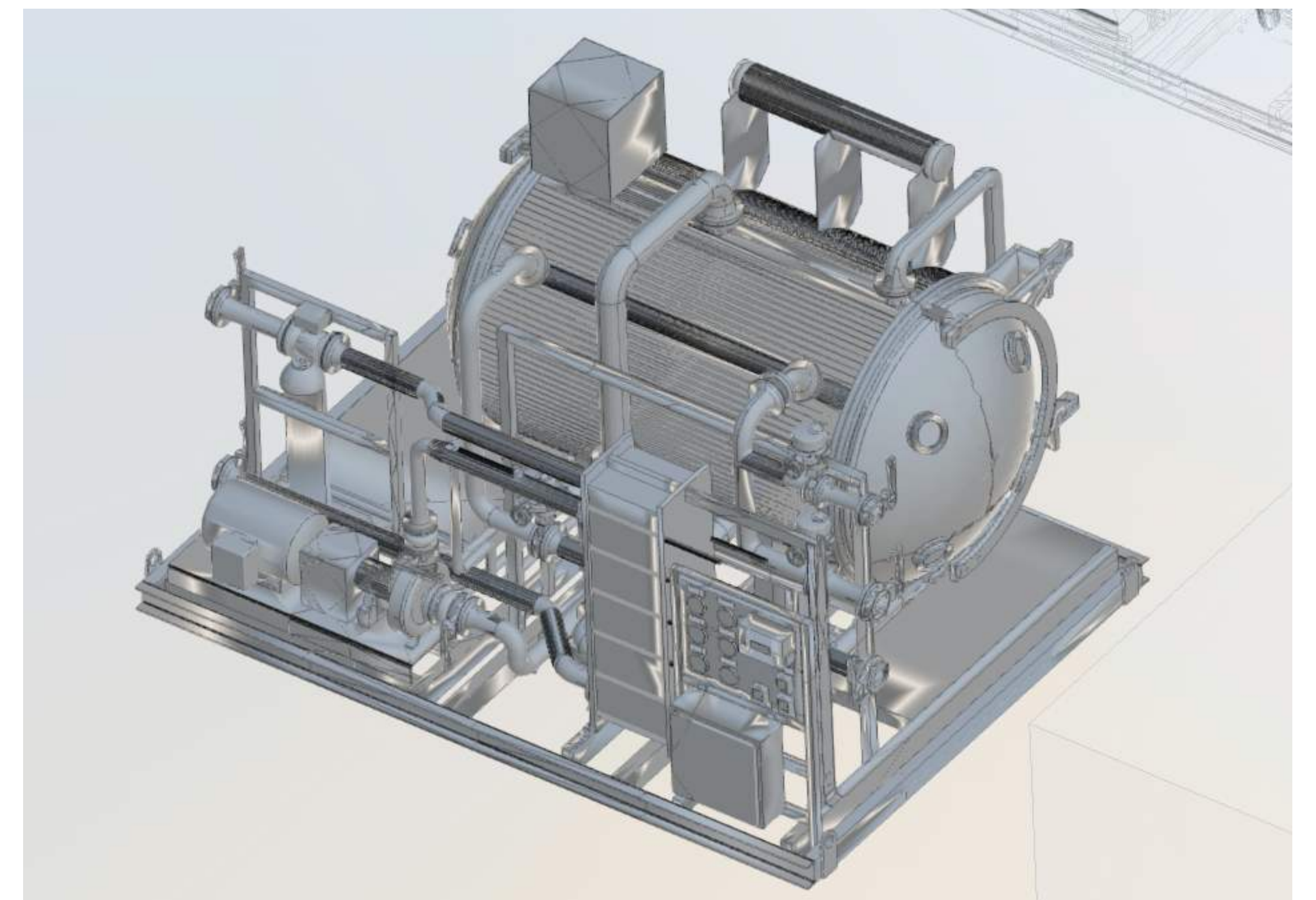
GAC



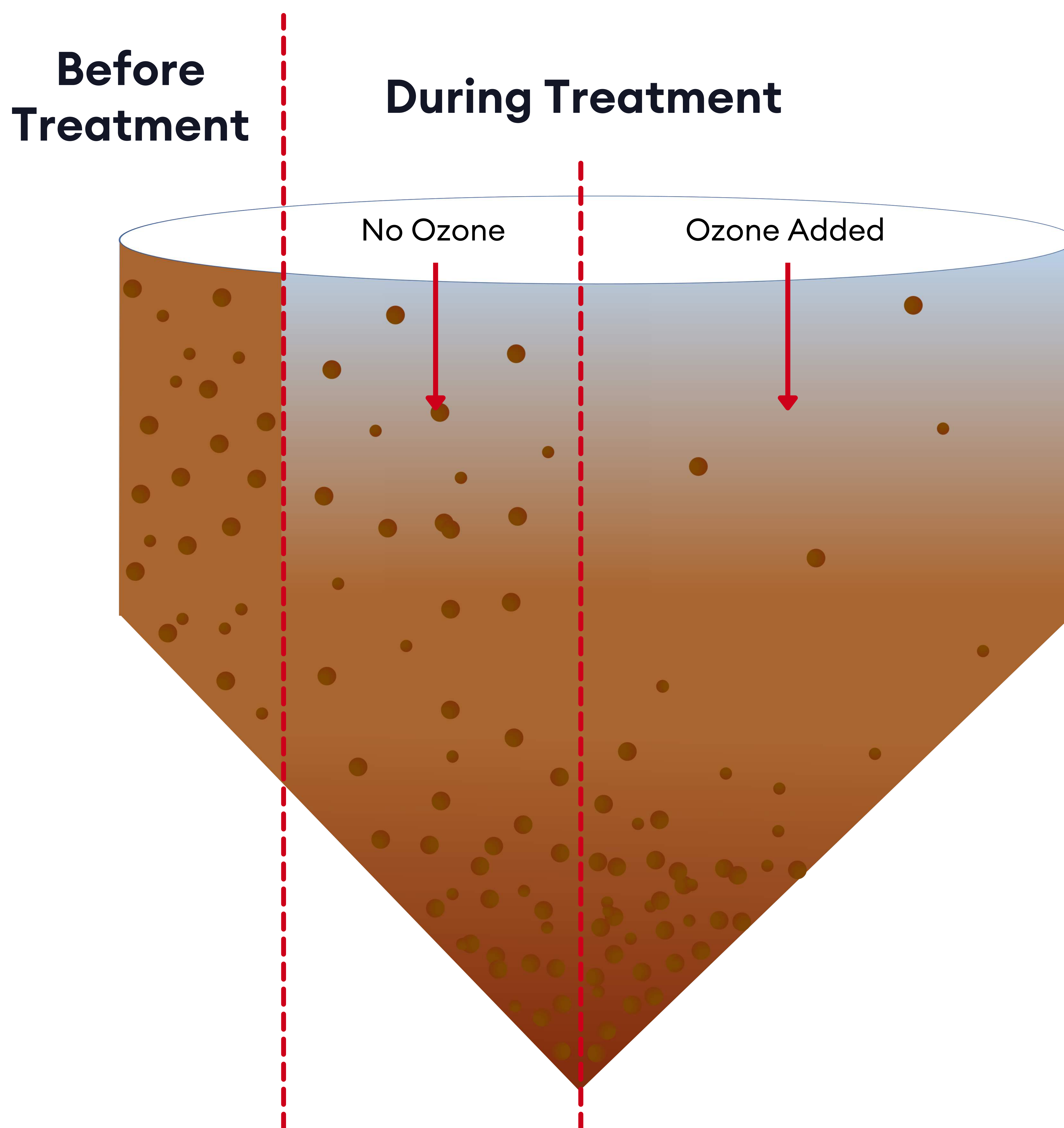
# Pre-Ozonation

## Why do we add ozone?

Changes the flavor of the TOC. This enhancement helps remove more TOC from the water.



3D model of the planned water treatment plant's ozone generator



Pre-Sedimentation

Pre-Ozonation

Flocculation/  
Sedimentation

Intermediate  
Ozonation

Biofiltration

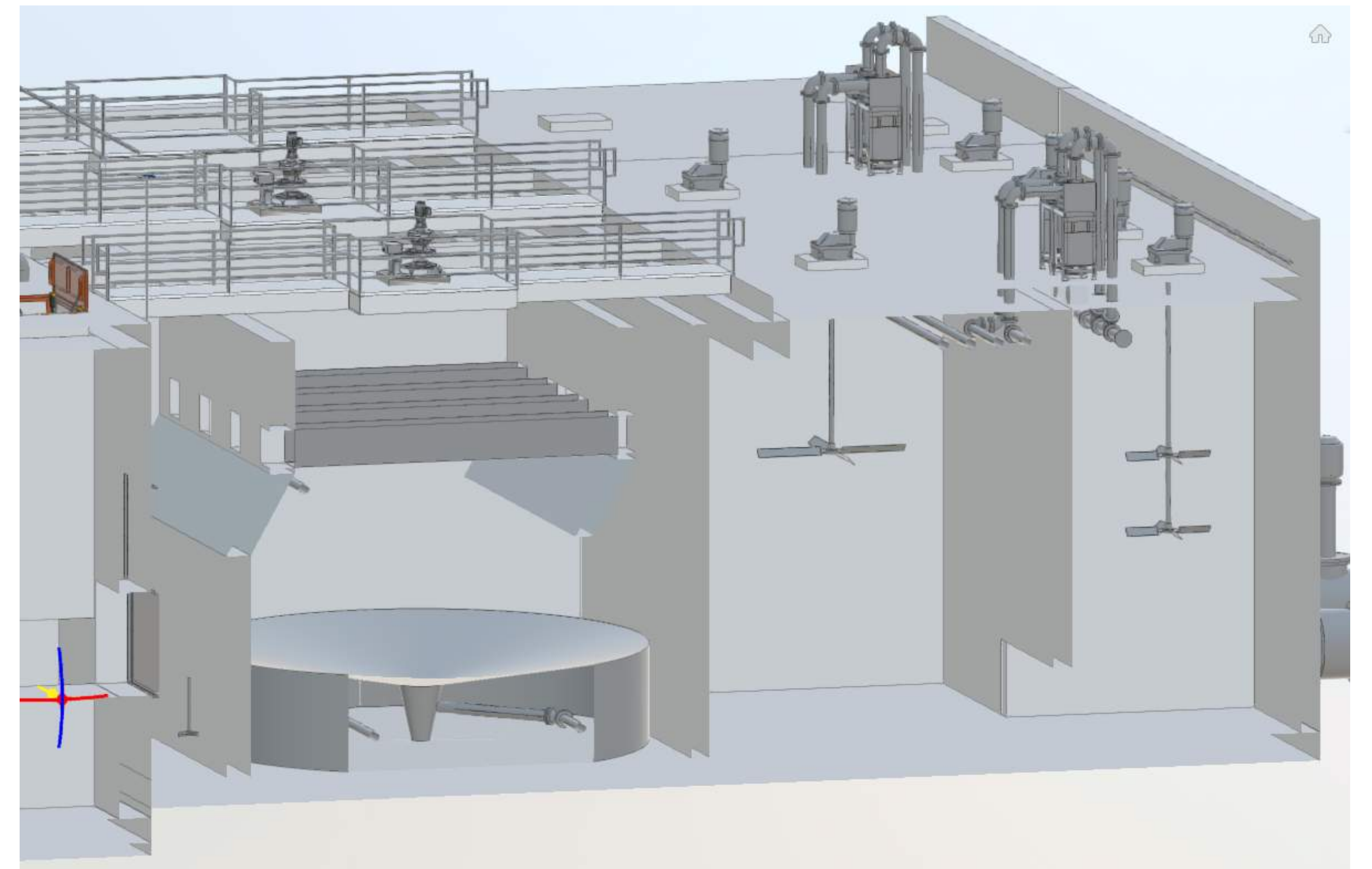
GAC



# Flocculation & Sedimentation

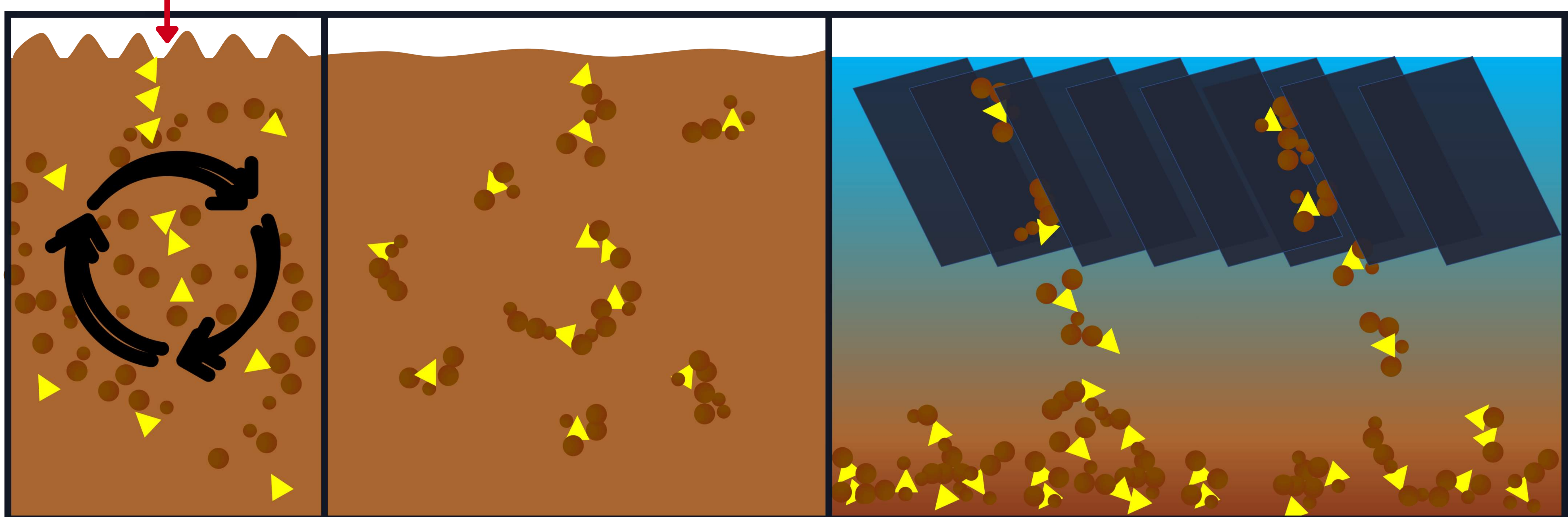
## What are Flocculation & Sedimentation?

Flocculation helps smaller solids clump up with other solids with the help of chemicals. These clumps are then removed during sedimentation. Plate settlers help the clumps fall to the bottom of the water.



3D model of the planned water treatment plant's ballasted flocculation treatment process

Chemical Addition



Rapid Mix

Gentle Mix for Floc Formation

No Mixing During Sedimentation

Pre-Sedimentation

Pre-Ozonation

Flocculation/  
Sedimentation

Intermediate  
Ozonation

Biofiltration

GAC



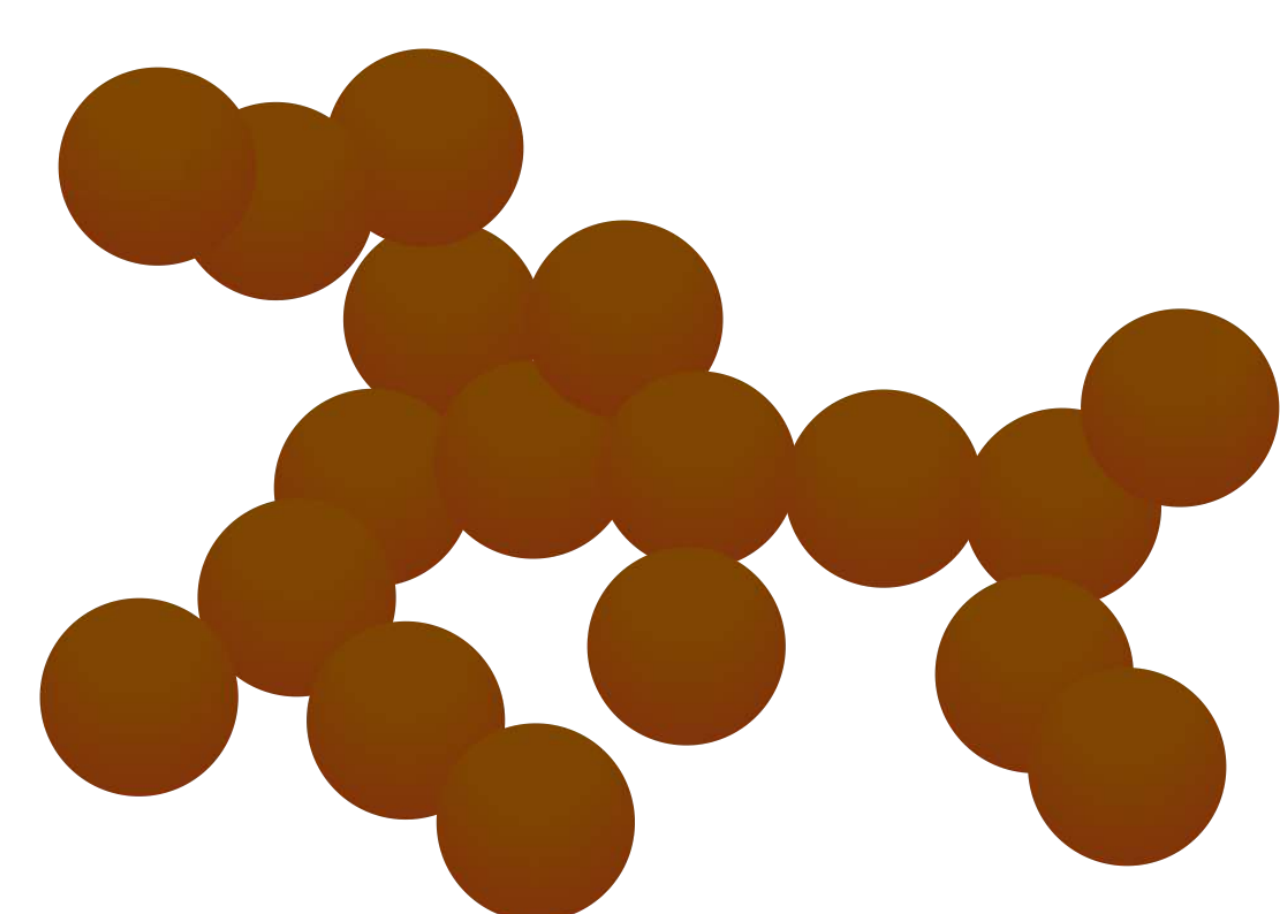
# Intermediate Ozonation

## Why are we ozonating?

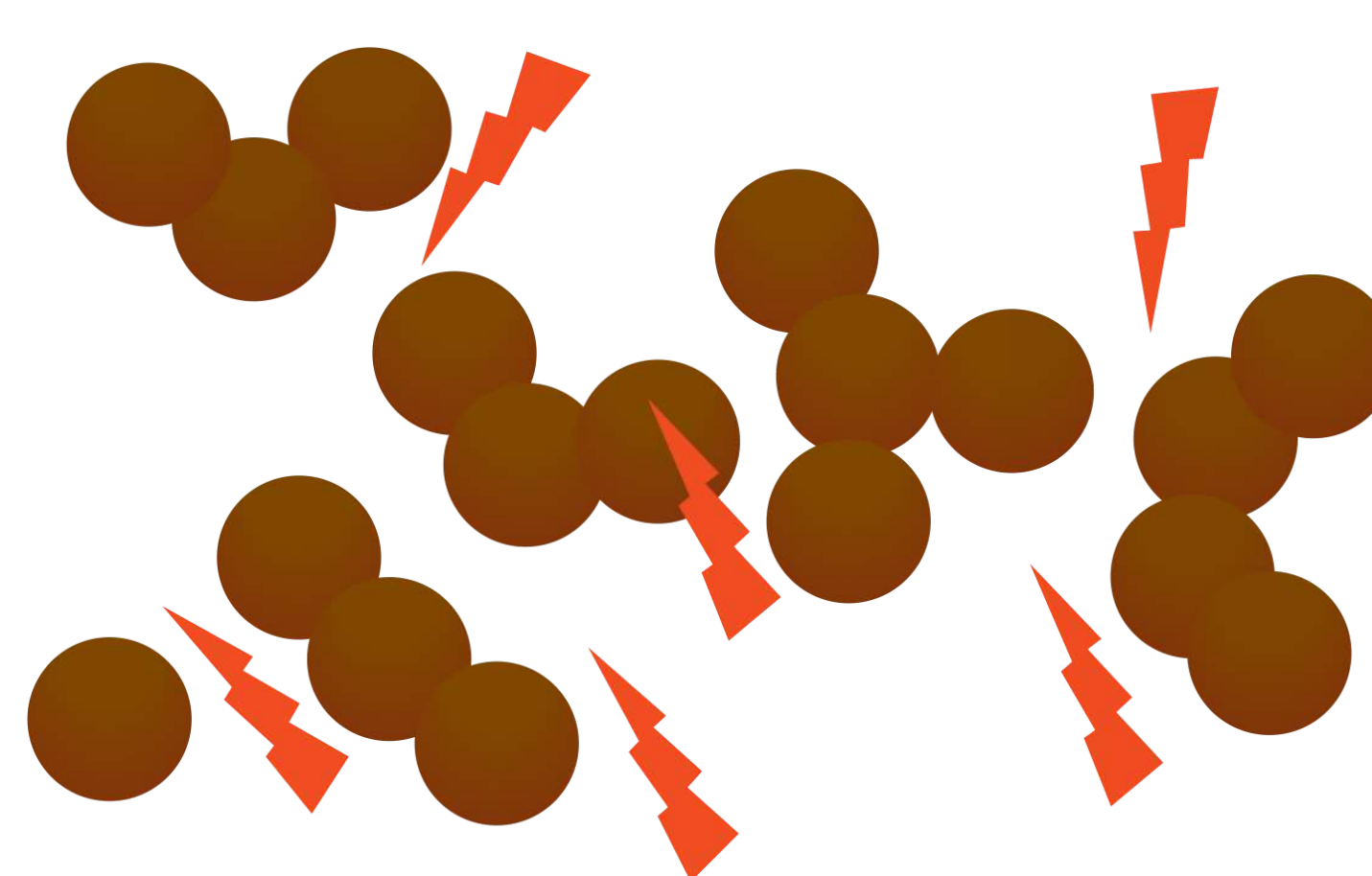
Ozone breaks down any remaining TOC into smaller chunks. These smaller bits of TOC are easier for microbes in the biofilters to munch on.



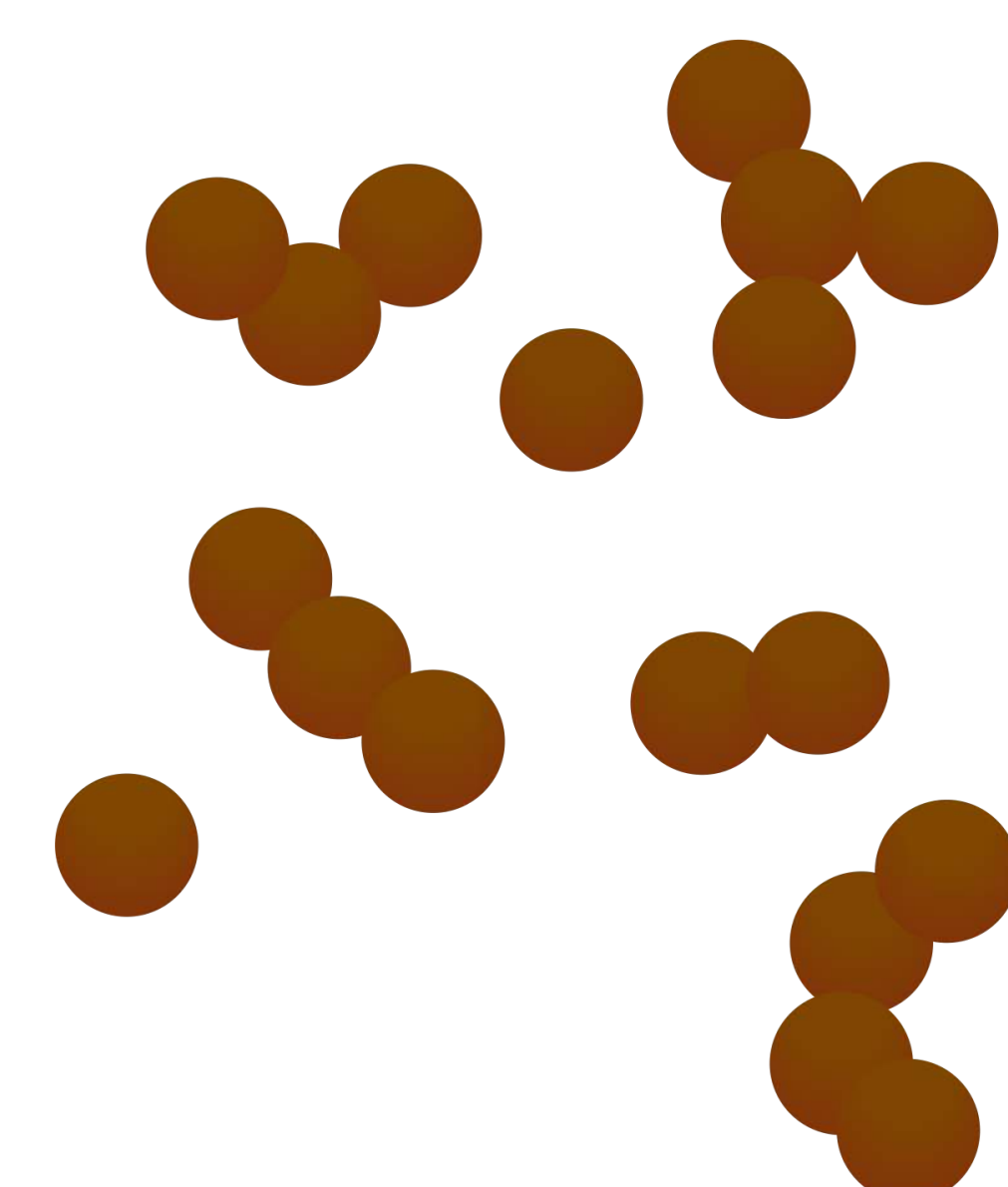
3D model of the planned water treatment plant's ozone contactors



Large Organic Molecule



Ozone Addition



Smaller Chunks of TOC



Pre-Sedimentation

Pre-Ozonation

Flocculation/  
Sedimentation

Intermediate  
Ozonation

Biofiltration

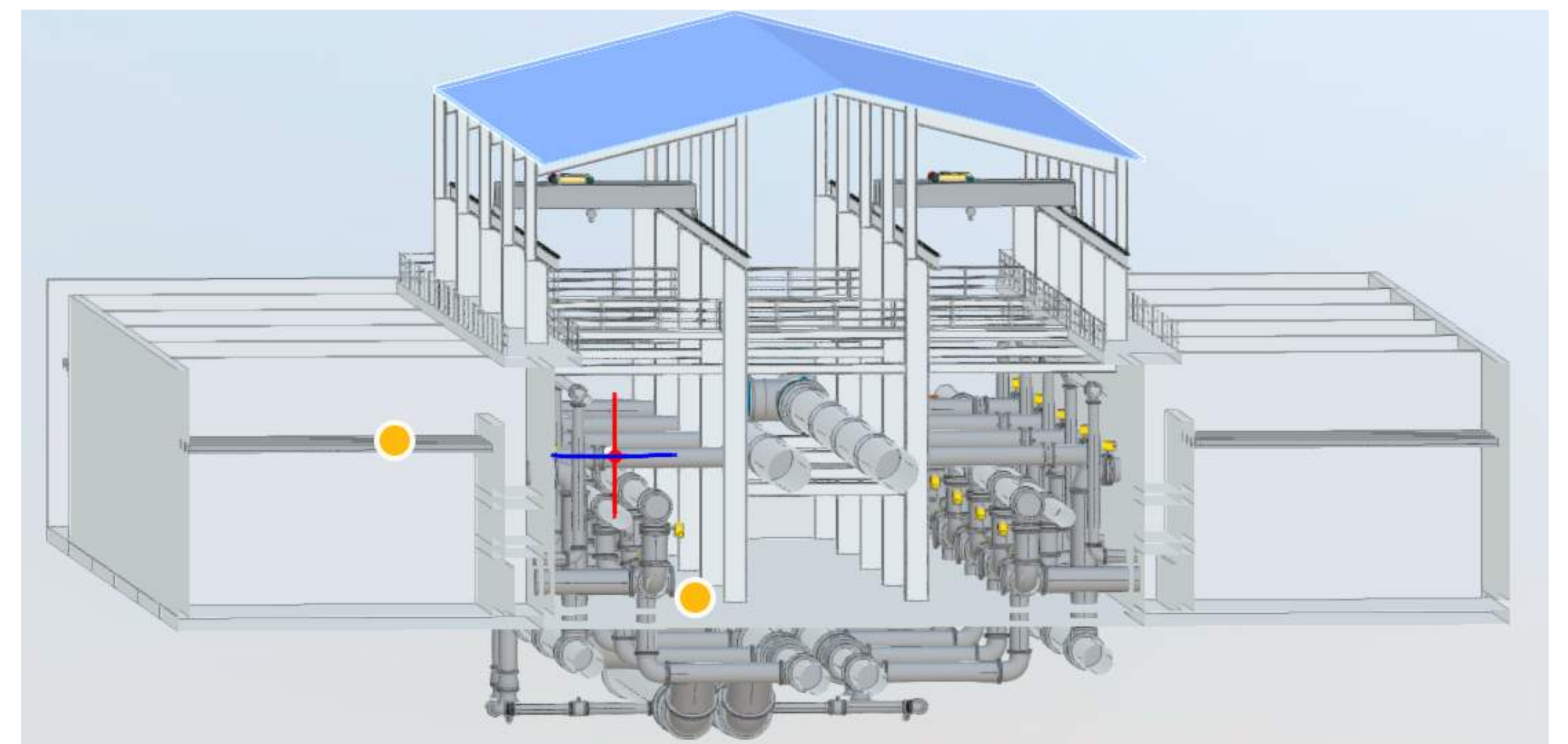
GAC



# Filtration

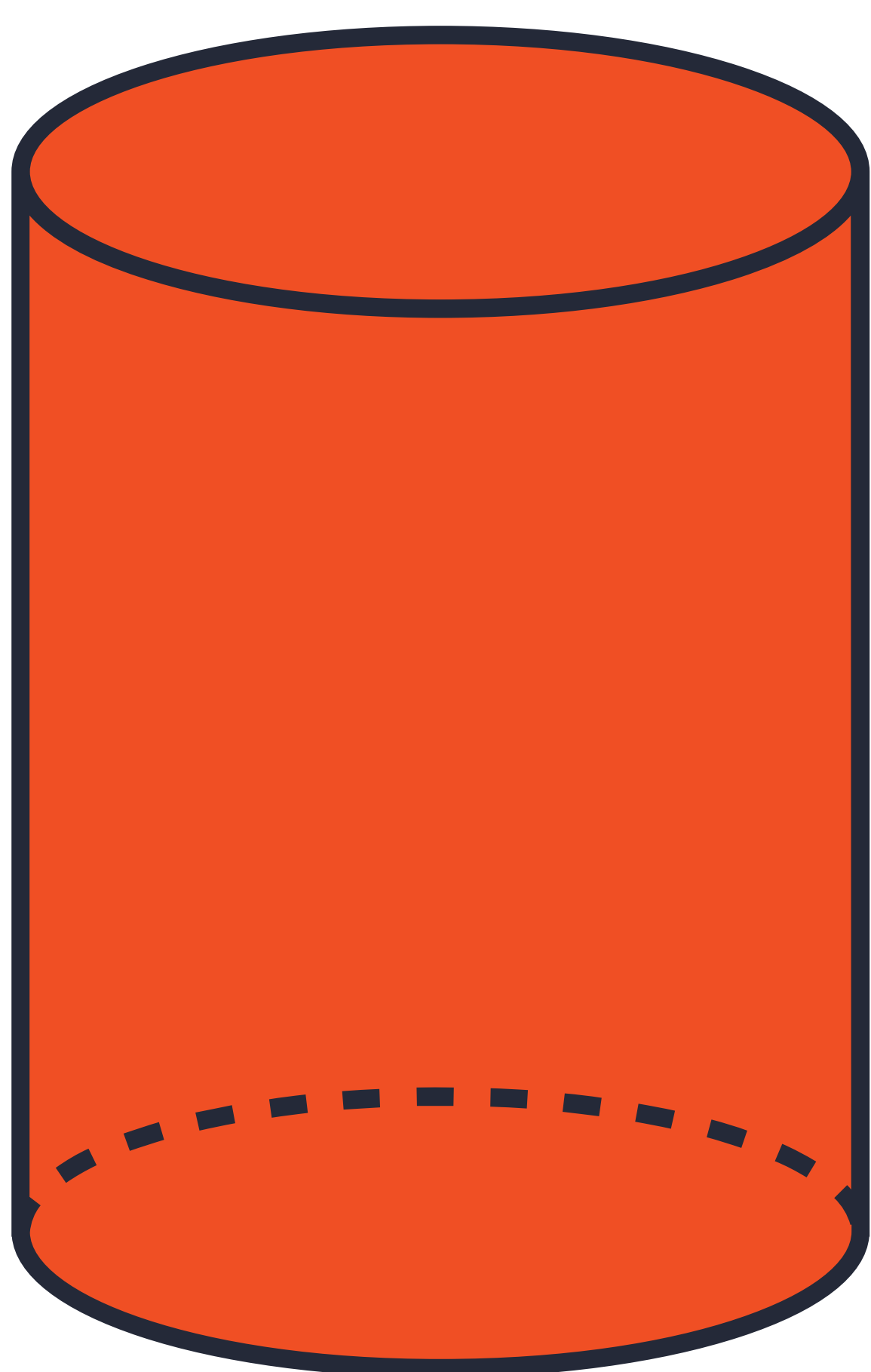
## What is biofiltration?

This process uses filter media to remove turbidity and helpful bacteria to remove TOC



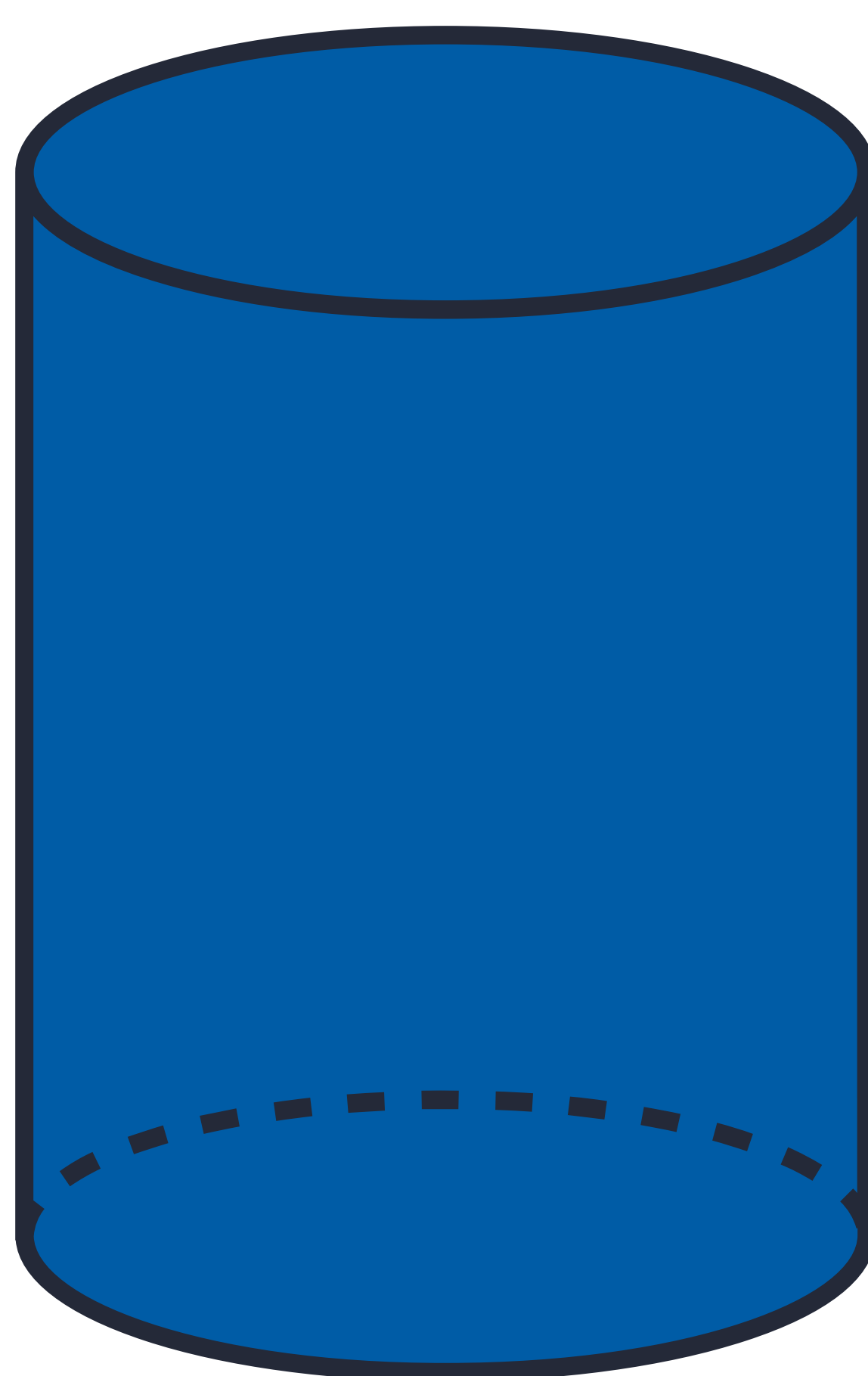
3D model of the planned water treatment plant's filter complex

**Just Water**



Control

**Chlorine**



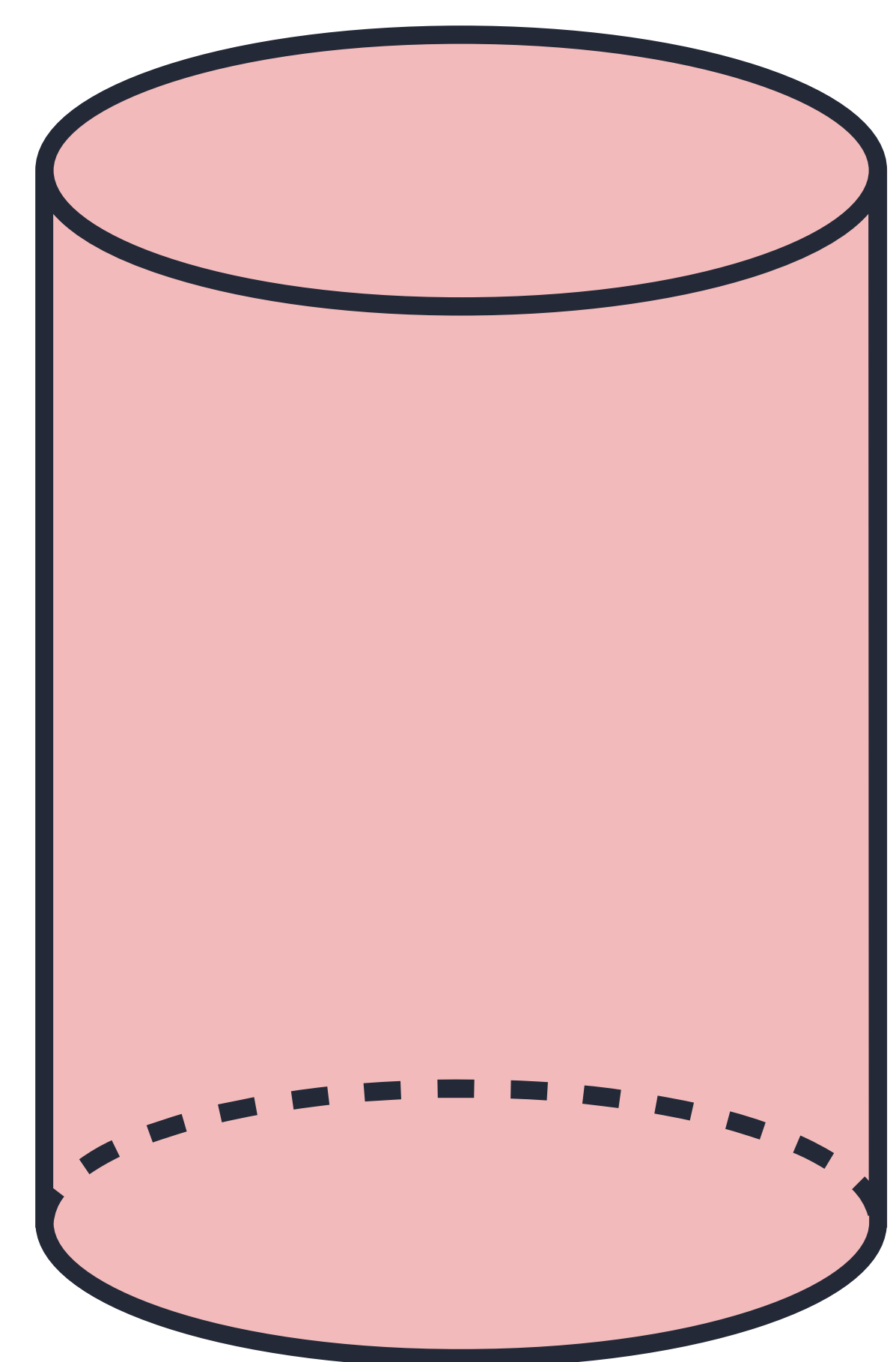
Chlorine is a disinfectant. Adding it before the filter forms DBPs early. We want to know if the filter will remove these DBPs.

**Ozone**



How well do the microbes remove the smaller TOC chunks?

**Ozone,  
Phosphate**



Phosphate is extra microbe food. How well do the microbes remove the smaller TOC chunks with extra food available?

Pre-Sedimentation

Pre-Ozonation

Flocculation/  
Sedimentation

Intermediate  
Ozonation

**Biofiltration**

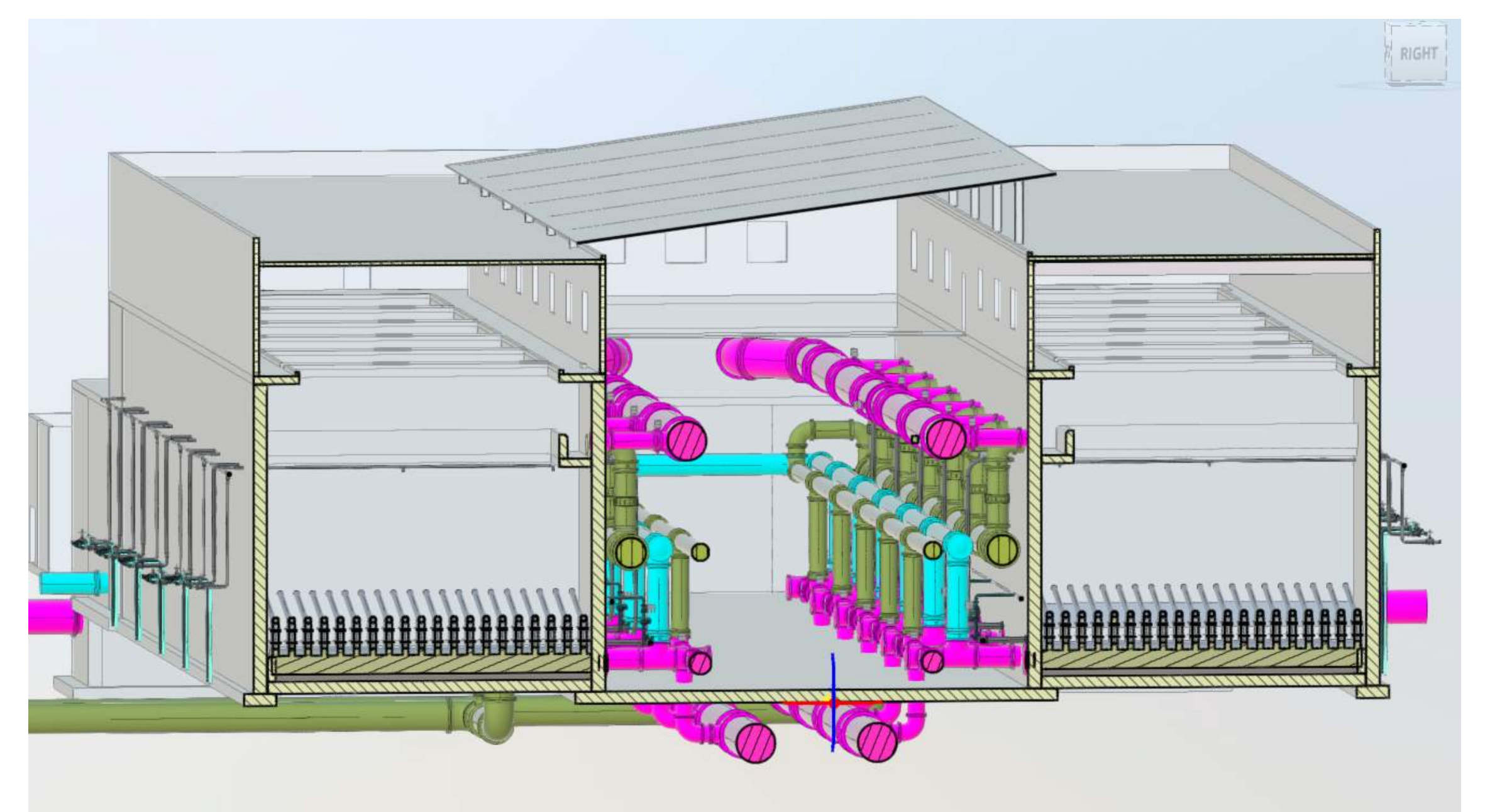
GAC



# Granular Activated Carbon (GAC)

## What is granular activated carbon?

GAC removes contaminants by having them stick to the surface of the filter's grains. Two filters have chlorine added to the water to preform DBPs, then evaluate how well the GAC reduces their concentrations



3D model of the planned water treatment plant's GAC contactors

